

REMARKS

The Office Action dated December 28, 2004, has been received and reviewed.

Claims 1-5, 11-17, 25-28, and 33-38 are currently pending and under consideration in the above-referenced application. Each of claims 1-5, 11-17, 25-28, and 33-38 stands rejected.

Reconsideration of the above-referenced application is respectfully requested.

Rejections Under 35 U.S.C. § 103(a)

Claims 1-5, 11-17, 25-28, and 33-38 have been rejected under 35 U.S.C. § 103(a).

The standard for establishing and maintaining a rejection under 35 U.S.C. § 103(a) is set forth in M.P.E.P. § 706.02(j), which provides:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Tsai in View of Lancaster

Claims 1-4, 11-14, 16, 25-27, 33-35, and 37 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over the subject matter taught in U.S. Patent 5,712,185 to Tsai et al. (hereinafter "Tsai"), in view of teachings from U.S. Patent 4,835,584 to Lancaster (hereinafter "Lancaster").

Tsai teaches a process in which a trench 38 is formed through a photomask 37, a sacrificial silicon oxide layer 36, a silicon nitride layer 34, and a pad oxide layer 32, and into a silicon substrate 30, as shown in FIGs. 3C and 3D. *See also* col. 2, line 53, to col. 3, line 18. Once the trench 38 is formed, the photomask 37 is removed and the edges of the remainder of the silicon nitride layer 34A are etched back, as depicted by FIG. 3E. *See also* col. 3, lines 9

and 19-33. Thereafter, exposed silicon at the surfaces of the trench 38A is oxidized to form side wall oxidation 39. FIG. 3F; col. 3, lines 34-38.

The teachings of Lancaster are directed to a process that includes forming an oxide lining 52a within trenches 56 that have been formed in a silicon substrate 50. FIG. 5D; col. 3, lines 43-45. After the oxide lining 52a has been formed, a silicon nitride mask layer 53 that overlies the active surface of the silicon substrate 50, but does not cover the surfaces of the trenches 56, is removed. FIG. 5E; col. 3, lines 39-42. Notably, the *entire* silicon nitride mask layer 53 is removed. *Id.* The oxide lining 52a, which is included merely for the sake of providing etch selectivity to prevent enlargement of the trenches 56 during removal of the silicon nitride mask layer 53 (col. 3, lines 43-45), is removed following removal of the silicon nitride mask layer 53. Col. 3, lines 46-49 and 54-58.

It is respectfully submitted that there are at least three reasons that a *prima facie* case of obviousness has not been established against any of claims 1-4, 11-14, 16, 25-27, 33-35, or 37. By way of reminder, in determining whether a *prima facie* case of obviousness exists, the teachings of the references must be considered in their entireties. M.P.E.P. § 2141.02.

First, it is respectfully submitted that Lancaster teaches away from the subject matter recited in claims 1-4, 11-14, 16, 25-27, 33-35, and 37. Independent claims 1, 11, 25, and 33 are drawn to methods, each of which include applying material over a buffer film layer to substantially fill a trench. It has been asserted that the silicon nitride layer of Lancaster is analogous to the “buffer film layer” recited in the claims. Nonetheless, Lancaster very clearly teaches that the silicon nitride layer is completely removed before trenches are substantially filled. Therefore, Lancaster teaches away from the subject matter recited in independent claims 1, 11, 25, and 33, as well as from that recited in claims 2-4, 12-14 and 16, 26-27, and 34-35 and 37 depending respectively therefrom.

Second, it is respectfully submitted that the references teach away from the asserted combination. Lancaster teaches complete removal of a silicon nitride layer prior to filling trenches. This teaching is inconsistent with Tsai’s teaching that a silicon nitride layer remain in place until after trenches are filled to “act[] as an end point detecting layer during [a] CMP

process” in which dielectric, trench-filling material that overlies the plane of the silicon nitride layer is removed. Tsai, col. 3, lines 51-56; FIG. 3G.

Third, it is respectfully submitted that one of ordinary skill in the art would not have been motivated to combine teachings from Tsai and Lancaster in the manner that has been asserted. In addition to teaching away from the combination, it is submitted that no motivation to combine reference teachings exists because the descumming process taught in Tsai, in which very small portions of the silicon nitride layer are removed, would not be as likely to remove silicon from trenches as the more radical, complete silicon nitride removal process taught in Lancaster. Therefore, without improperly relying upon the disclosure of the above-referenced application, one of ordinary skill in the art would have seen no reason to line trenches with silicon oxide before etching back the edges of the silicon nitride layer, as taught in Tsai.

It is, therefore, respectfully submitted that the teachings of Tsai and Lancaster do not support a *prima facie* case of obviousness against any of claims 1-4, 11-14, 16, 25-27, 33-35, or 37. Accordingly, under 35 U.S.C. § 103(a), each of these claims is drawn to subject matter which is allowable over the teachings of Tsai and Lancaster, taken either separately or together.

Tsai, Lancaster, and the Examiner's Comment

Claims 17 and 38 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is allegedly unpatentable over that taught in Tsai, in view of the teachings of Lancaster and, further, in view of the Examiner's Comment.

Claim 17 is allowable, among other reasons, for depending indirectly from claim 11, which is allowable.

Claim 38 is allowable, among other reasons, for depending indirectly from claim 33, which is allowable.

Tsai, Lancaster, and Lee

Claims 5, 15, 28, and 36 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is purportedly unpatentable over that the subject matter taught in Tsai, in view of teachings from Lancaster and, further, in view of the teachings of Lee, HS, et al., “An Optimized

Densification of the Filled Oxide for Quarter Micron Shallow Trench Isolation (STI)," 1996
IEEE Symposium on VLSI Technol. Dig. of Technical Papers, pages 158-59.

Claims 5, 15, 28, and 36 are allowable, among other reasons, for depending directly from
claims 1, 11, 25, and 33, respectively, which are allowable.

CONCLUSION

It is respectfully submitted that each of claims 1-5, 11-17, 25-28, and 33-38 is allowable.
An early notice of the allowability of each of these claims is respectfully solicited, as is an
indication that the above-referenced application has been passed for issuance. If any issues
preventing allowance of the above-referenced application remain which might be resolved by
way of a telephone conference, the Office is kindly invited to contact the undersigned attorney.

Respectfully submitted,



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